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THE INSECTS OF ANCIENT AMERICA.

BY S. H. SCUDDER.

UNTIL within a very few years not more than four or five kinds of fossil insects had been found on this continent. Indeed, little thought had been bestowed upon their possible discovery, and while hundreds of eager students had carefully examined the living insects, few turned to the ancient representatives of this class upon the globe. New and interesting discoveries have thrown some light upon the insect-life of Ancient America, but even now, the known species, occurring in many localities and in various deposits, will not number one hundred different kinds.

The discovery of the oldest insect remains in the world is due to Mr. C. F. Hartt. While collecting fossil plants in the Devonian slates near St. John, New Brunswick, he first perceived faint traces of insects' wings. Few persons would have noticed these insignificant relics, but Mr. Hartt having discovered a single insect, thoroughly examined all his rock specimens until six other fossils were brought to light. In the more carefully gleaned fields of

Europe, a few species have been found as low down as the Carboniferous rocks of Wetterau, Saarbrück, etc., but these fossils from the Upper Devonian carry the first appearance of insect-life back to a previous epoch, and make their advent in North America synchronous with that of land plants.

The specimens obtained by Mr. Hartt are intrinsically interesting; although they are all fragments, broken generally from the centre of the wing, enough distinctive parts remain to determine the character of the fossils. They are all Neuroptera, or Lace-winged flies, and, with the exception of one or two Ephemerina, or May-flies, represent families which are now extinct. One of them is provided with a few veins forming concentric rings near the base of the wing; these rings bear such a striking resemblance to the stridulating organ of the green grasshoppers, that I am inclined to believe there were chirping Neuroptera in those days!

Similar in interest are some specimens of Neuroptera from the Carboniferous beds of Morris, Illinois; they occurred in small flattened iron-stone concretions, like the clay-stones in clay banks of the present day. These Neuroptera also represent families distinct from any now living, and, like many of the Devonian insects, are synthetic in character; that is, combine in one and the same form features which, in after ages, are distributed among the members of different families. In this case the synthesis unites families belonging to different sections,—some to Neuroptera proper, others to Pseudo-neuroptera. The Neuroptera proper include those families where the pupæ are inactive, and the limbs are folded against the body; such as the Sialina, Hemerobina, Mantispadæ, Panorpina, and Phryganina (Caddis-flies). In the Pseu-

do-neuroptera—classed by some naturalists with Orthoptera—the pupæ are active and are provided with rudimentary wings; otherwise they differ but little from the larvæ: among them are the Termitina (white ants), Psocina, Perlina, Ephemerina (May-flies), and Odonata (Dragon-flies). Had these insects of former days active or inactive pupæ?

Two other remains were found in these iron-stone concretions; they appear to me to be those of worms, but naturalists have described one form as a centipede, the other as a caterpillar of a moth; the caterpillar was referred to the family of Arctians, to which our woolly caterpillars belong. The last, if true, would be a most interesting discovery; for in Europe only one moth, and that of the lowest family, the Tineids (of which the clothes-moth is a member), has been found as low down as the Jurassic period.

Dr. Dawson, of Montreal, has been quite fortunate in discovering various kinds of insects in the coal-beds of New Brunswick and Nova Scotia; traces of the mining of larvæ were found on the leaf of a fossil fern, and this was the more remarkable because ferns in our day are peculiarly exempt from attack by mining insects. Among the fossil remains were numerous fragments of Myriapods, which had secreted themselves in the trunks of decayed trees; coprolites of the reptiles which had sought shelter in the hollow trunks proved that the animals fed partially, at least, upon insects,—they were filled with comminuted fragments of the bodies and limbs of Orthoptera and Neuroptera of large size, and, in one instance, Dr. Dawson found the eye of a dragon-fly.

Professor Marsh, of New Haven, has also obtained an insect's wing at the Joggins in Nova Scotia; he thought

it similar to a cockroach's wing found by Professor Lesquereux in the Carboniferous rocks of Frog Bayou, Arkansas, but it was put away at the time of its collection, and has never since been examined. Mr. Barnes has just discovered a wing of a similar kind in the coal formation of Pictou. There has been but one other instance—and that of very recent date—where a fossil insect has been found in the Carboniferous rocks of this country; it was the case of a single wing, gigantic in size, peculiarly veined, and probably allied to our May-flies, which occurred in the coal-beds of Cape Breton, Nova Scotia.

Professor Hitchcock, in his examination of the footprints in the New-Red Sandstone of the Connecticut Valley, described and figured some small tracks which he supposed to have been made by insects; but the footprints of insects have been little studied, and the whole subject is so difficult in its nature, that it would be an arduous task to prove whether the tracks were made by insects or not. In the shales accompanying the New-Red Sandstone, however, quite a large number of insect remains have been found, all of which belong to the larva of a single species. Professor Hitchcock believed them to be neuropterous, but I think they should be referred to the Coleoptera, or beetles. The species must have lived in the water, since the specimens are comparatively numerous; on a small slab I have counted more than twenty individuals.

Professor William Denton has obtained the largest collection of fossil insects which has yet been made in this country. The specimens were brought from an uninhabited region beyond the Rocky Mountains, near the junction of the White and Green Rivers, Colorado,—a deposit probably far richer than that of Œningen, in Switzerland. Professor Denton was able to obtain but

few specimens while passing rapidly through the country, but he describes the shales in which they occur as a thousand feet thick, varying in color from a light cream to inky blackness, and crowded with the remains of insects and leaves of deciduous trees. Between sixty and seventy species of insects were brought home, representing nearly all the different orders; about two-thirds of the species were flies,—some of them the perfect insect, others the maggot-like larvæ,—but, in no instance, did both imago and larva of the same insect occur. The greater part of the beetles were quite small; there were three or four kinds of Homoptera (allied to the tree-hoppers), ants of two different genera, and a poorly preserved moth. Perhaps a minute Thrips, belonging to a group which has never been found fossil in any part of the world, is of the greatest interest. At the present day, these tiny and almost microscopic insects live among the petals of flowers, and one species is supposed by some entomologists to be injurious to the wheat; others believe that they congregate in the wheat, as well as in the flowers, in the hope of finding food in the still smaller and more helpless insects which congregate there. It is astonishing that an insect so delicate and insignificant in size can be so perfectly preserved on these stones; in the best specimens the body is crushed and displaced, yet the wings remain uninjured, and every hair of their broad, but microscopic fringe, can be counted.

The specimens came from two localities about sixty miles apart, called by Professor Denton Chagrin Valley and Fossil Cañon; these two faunas are apparently quite distinct: the ants, the moth, the thrips, nearly all the small beetles and the greater part of the flies come from Fossil Cañon, while the larvæ are restricted to Chagrin Valley.

While no definite conclusion can be drawn concerning the age of the rocks in which these remains occur, there can be little doubt that they belong to the Tertiary epoch. Professor Denton believes them to be at least as old as the Miocene.

The species of fossil insects now known from North America, number eighty-one: six of these belong to the Devonian, nine to the Carboniferous, one to the Triassic, and sixty-five to the Tertiary epochs. The Hymenoptera, Homoptera, and Diptera occur only in the Tertiaries; the same is true of the Lepidoptera, if we exclude the Morris specimen, and of the Coleoptera, with one Triassic exception. The Orthoptera and Myriapods are restricted to the Carboniferous, while the Neuroptera occur both in the Devonian and Carboniferous formations. No fossil spiders have yet been found in America.

EXPLANATION OF PLATE 16.

Fig. 1. *Miamia Bronsoni.* A neuropterous insect found in ironstone concretions in the Carboniferous beds at Morris, Illinois. The figure is magnified one-third, and has all its parts restored; the dotted lines indicate the parts not existing on the stone. Reduced from a figure in the Memoirs of the Boston Society of Natural History, Vol. I.

Fig. 2. *Archimylacris Acadica.* Wing of a Cockroach observed by Mr. Barnes in the coal-formation of Nova Scotia.

Fig. 3. *Platephemera antiqua.* A gigantic May-fly obtained by Mr. Hartt in the Devonian rocks of New Brunswick.

Fig. 4. *Xylobius sigillariæ.* The Myriapod (or Gally-worm) found in the coal-formation of Nova Scotia, by Dr. J. W. Dawson. Copied from a figure in Dr. Dawson's Air-breathers of the Coal-period. Magnified.

Fig. 5. *Lithentomum Hartii.* A neuropterous insect, the specimen first discovered by Mr. Hartt in the Devonian rocks of New Brunswick. This fossil, and those accompanying it, are the oldest insect-remains in the world.

Fig. 6. Three facets from the eye of an insect, considered by Dr. Dawson a Dragon-fly. It was found in coprolites of reptiles in the

Fig. 1.

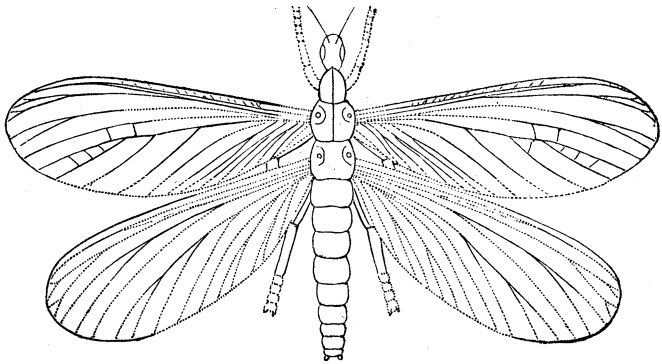


Fig. 2.

Fig. 3.

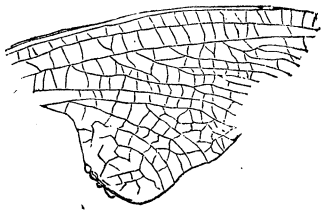


Fig. 4.

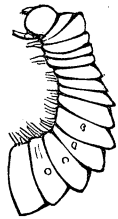


Fig. 5.

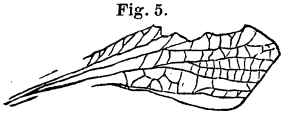


Fig. 6.

Fig. 7.

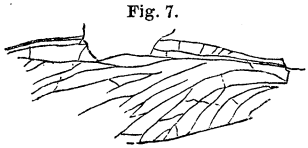
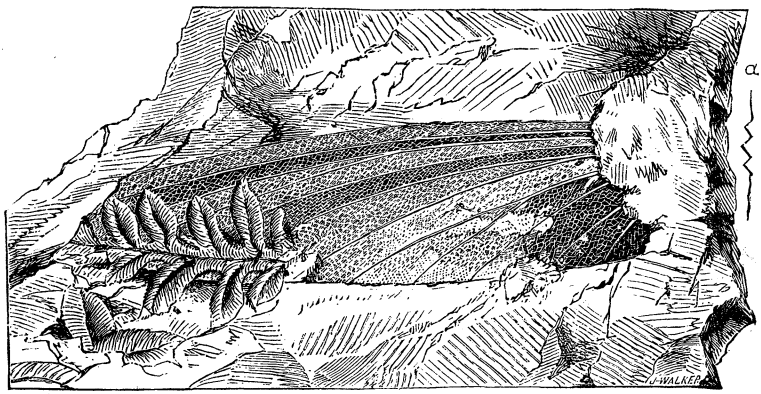


Fig. 8.



rocks containing the myriapod, represented in Fig. 4. Copied from Dr. Dawson's figure, greatly magnified.

Fig. 7. *Homothetus fossilis.* A neuropterous insect from the Devonian rocks of New Brunswick; it was discovered by Mr. Hartt.

Fig. 8. *Haplophlebium Barnesii.* A curious neuropterous insect, of large size, probably allied to our May-flies; taken by Mr. Barnes from the coal of Cape Breton.

These figures, with the exception of 1, 4, and 6, are of life size, and borrowed from the new edition of Dr. Dawson's Acadian Geology.

THE HAND AS AN UNRULY MEMBER.

BY BURT G. WILDER, M. D.

(Concluded from page 491.)

Fracture or Crossing. This is the name given to a view of the limbs, which, under various modifications, has been entertained by four celebrated anatomists, Bourgery, Cruveilhier, Flourens, and Owen. Its essential feature is the pronation of the forearm so as to bring the thumb on the inner side, opposite the great toe; but this has the effect of crossing the radius upon the ulna, so that its upper end is to the outer, while its lower end is to the inner side of that bone. This condition of things, though contrary to the relation of the corresponding parts in the leg, is accepted by Owen* and Flourens, who simply seek to show that the front of the arm really corresponds to the front of the leg, and *vice versa*, so that the concavity of the elbow is made to represent the convexity of the knee; but the other two anatomists try to explain the crossing of the bones, upon an idea which was distinctly enunciated by Cruveilhier, in the following propositions:

"1. Neither bone of the leg is represented by a single bone of the arm.

*Comparative Anatomy of Vertebrates, ii. 310, 360.